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whether he would include also later deficiencies in return, or, if not, where the line should be drawn between those to be included in capital and those to be borne as losses by the investors. Also, while he holds that going value should be allowed, whatever basis of valuation be used, he does not make clear just how the amount should be determined in the case of an appraisal. As he presents the general idea, it appears to the reviewer as a category of actual cost or experience, to be shown only by the company's individual records. The thing would not be disclosed by an appraisal, for with like property the actual costs would differ greatly from one company to another. In the case of a new undertaking, the author's classification may be followed satisfactorily, but I do not see how it can be used if fair value can not be determined from the company's records, but must be established by the means of a physical valuation.

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*Engineering Economics: First Principles.* By JOHN CHARLES LOUNSBURY FISH. (New York: McGraw-Hill Book Company. 1915. Pp. xii, 217. \$2.00.)

The author's aim is well stated in his preface:

Every engineering structure, with few exceptions, is first suggested by economic requirements; and the design of every part, excepting few, and of the whole is finally judged from the economic standpoint. . . . It is therefore apparent that the so-called principles of design are subordinate to the principles which underlie economic judgment. . . . This important fact usually escapes the student of engineering because, while he may have seen hundreds of books on the principles of design and his time is largely employed in studying these principles and their application, he has seen not one book devoted to the principles which underlie economic judgment, and his books and his instructors merely mention these in passing. . . . The present work was undertaken with the belief that to the engineer a working knowledge of first principles is as essential in the economics as in the mechanics of structures; and that special study and drill in the application of principles is as advantageous in the one case as in the other. . . . The book is intended to meet the first needs of the student, and to render effective service in the office. It is hoped that it will facilitate the introduction of formal instruction in engineering economics in the engineering schools, and assist sound engineering practice.

The book is divided into five parts as follows: I, Introductory, pp. 1-4; II, Elements of the Problem of Economic Selection, pp.

5-108. This part contains chapters upon Interest (simple and compound), Sinking Funds, First Cost, Salvage Value, Elements of Yearly Cost of Service, and Estimating; III, Solution of the Problem of Economic Selection, pp. 109-148. The titles of the chapters are: Basis of Economic Comparison, Procedure for Economic Selection, Examples of Economic Selection; IV, Bibliography and Depreciation and Life Tables, pp. 149-175; V, Tables, including tables of formulas and tables of values, pp. 176-206. The index and contents are prepared in detail.

The usual mathematical formulas, with a few illustrative examples, are given for interest, present worth, discount, etc. Applications are then made in considerable detail to sinking funds with the usual mathematical developments in which simple algebra and the elements of logarithms are used. The chapter on First Cost contains, very naturally, no formulas, but consists of a discussion of the various elements which should be entered as first cost. The large number of items are covered briefly but clearly. The chapter on Salvage Value is divided between mathematical discussion, with illustrative examples, and general economic arguments without mathematical basis—a combination which seems particularly satisfactory in a difficult and debated, indeed debatable, subject.

For depreciation formulas are given the straight line formula, the sinking fund formula, the Matheson and the Gillette formulas, and the formula called "Equal Profit Ratios." The examples which are worked out by these different formulas show how very different the salvage value is when determined by the different assumptions which lead to the formulas. The following table summarizes the results in one example.

Formula	Salvage value at age five years	Ratio of yearly profit to investment, for the	
		Seller	Buyer
		<i>Per cent</i>	<i>Per cent</i>
Straight-line	\$5,000.00	5.95	56.9
Sinking-fund	5,606.83	7.05	48.2
Matheson	10.00	-3.08	39,976.9
Gillette	7,474.74	10.4	30.4
Equal profit ratios	10,335.17	15.61	15.61

It should be evident, therefore, that the question of selection among these formulas is of more vital importance than the use

of any one of them. Without intelligent selection, indeed, when the results of different calculations vary to the extent to which these vary, it may be somewhat doubted whether the calculations are of any practical value, and whether an intelligent engineer might not more simply, by the use of his judgment, arrive at a salvage value which would be just as reliable as any of these calculated values. Indeed, we might say that a totally inexperienced person, who is no engineer at all, would undoubtedly get a salvage value somewhere between the limits here obtained. This remark need not be interpreted as condemning any or all of the formulas, or as condemning the teaching of such formulas; for it is undoubtedly true that proper teaching along the lines of this chapter of Fish's text would aid materially in liberalizing the student's point of view as to the use of mathematics and economics in his every-day work.

Chapter 6 on the Elements of Yearly Cost of Service is again partly discussion and partly mathematical, and the following chapter on Estimating is largely a brief, but intelligent and intelligible, discussion of estimating.

The real essence of the work is, of course, contained in part III wherein the solution of the problem of economic selection is undertaken. The excellent feature of the teaching in this part is the stress laid upon the fact that, when all is said and done, the various calculations which may be made are to be used not blindly but merely as a help to the judgment of the engineer in making his decision between the economic values of two or more proposed structures. As this part of the work is to so great an extent illustrated by examples worked out for the benefit of the student, there should be no difficulty in making the subject interesting and effective with any class of engineers, and there is little chance to do more in a review than call attention to this fact.

One difficulty with the book from beginning to end is the complete lack of exercises for the students to do. The author says that "in connection with the lessons the student should be given many problems to solve in order that he may become self-reliant in the application of principles." It is my opinion that the hardest part of the teaching of the subject of this book would be, not to concoct thirty to fifty lectures upon it, but to bring together a well-selected list of exercises for the student to work; and I therefore do not hesitate in the slightest to say if such a list of

exercises were prepared, I should much rather use it than to use this book devoid of exercises as it is. It may well be that there would be considerable difficulty in selecting for the book a list of exercises of sufficiently general interest to be useful for teaching in different institutions and to different classes. Nevertheless, less than half of the work that the author should do is now done when he contents himself by remarking in the preface that the exercises should be furnished.

The last two parts contain, as has been stated, a bibliography and various tables. The bibliography is so long that it is difficult to judge how well selected it may be. The author has occasionally, through the text, referred to supplementary reading, and his bibliography may be intended to be used for special investigations in office work rather than for general additional instruction in the class room.

One subject of great economic importance, especially in regard to calculations relative to long enduring structures, has been touched too lightly by the author—the change of prices; in particular, the change in the general price level. In such a matter as salvage value or depreciation no discussion can be adequate which does not lay considerable stress upon future prices. Again, in economic matters the political element has to be taken into consideration, perhaps unfortunately. If a railroad engineer were to have calculated, a few years ago, on the question of steel versus wooden coaches, he might have decided that the wooden coach would be preferable; without, perhaps, taking into consideration the possibility that the Interstate Commerce Commission might, before the coach wore out, relegate it to the scrap heap by its imperial edict. And, in general, the question of choice between a more permanent and more costly structure on the one hand and a less permanent and less costly structure on the other has to be determined, to a very large extent, by one's judgment as to the *trend* of events, politically and socially as well as economically. From a strictly mathematical point of view it might be possible to allow for this possible judgment in some of the items used in the calculations previous to the exercise of the final decision, but wherever the future element should be entered, I believe that the importance of the dynamic in economics should be emphasized further in long distance estimates.

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